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Chemical Control of Poisonous Range Plants

By DALE W. BOHMONT
INTRODUCTION

No problem has been more persistent or more costly to the Wyoming livestock grower than the annual losses due to poisonous plants. While it is virtually impossible to obtain accurate data on the exact numbers of livestock lost directly or indirectly through poisonous plants, it is often estimated to be 3 percent to 5 percent, with losses in some years running over 15 percent. The difficulty of accurately ascribing the loss to a specific weed is readily appreciated when it is realized that the toxic effect of some plants is so rapid that no antidote can be administered effectively. Conversely, the cumulative poisons are often very slow in producing outward symptoms; thus the animal may be sold and already in a feed lot before the toxic effect of the poison can be recognized. Thus it is apparent that numerous gradations in poisonous properties, type of toxicity, and outward symptoms may be attributed to some poisonous plants.

CONTROL METHODS

Numerous solutions have been proposed. Control methods may generally be grouped into three categories:

1. Mechanical treatment
2. Biological control
3. Chemical control

Mechanical control involves use of machinery or hand implements for removal of undesired vegetation. This method has been utilized with various degrees of success for control of troublesome poisonous plants such as larkspur, death camas, and water hemlock. Because of the high cost of mechanical control, the areas of adaptation are very limited.

Biological control involves control of plants by insects or disease. While this method has been used only on a limited scale in the United States, it has proved to be very effective for control of such undesirable range plants as prickly pear in Australia and thorny shrub in the Hawaiian Islands.
Chemical control is probably the most recent and spectacular of the three methods. Before 1944 very little use was made of chemicals to control poisonous range plants. The chlorates, arsenites, and boron compounds in common use were too expensive and unadapted for the range weeds in Wyoming. Since soil sterilization lasting from two to five years resulted from this type of treatment, other methods of control were pursued.

With advent of growth-regulating compounds such as 2,4-D in 1944, weed control in all phases of agriculture took on a new aspect. It was found that many of the most troublesome perennial herbaceous weeds could be controlled in grassland with no noticeable injury to the grass. In addition to being a “selective weed killer,” 2,4-D was found to be nontoxic to humans or livestock, noncorrosive, relatively inexpensive, and easily applied as a spray in low volumes.

Large areas of infestation would not be well adapted to chemical control because of treatment cost in relation to rangeland productivity. However, since many of the common poisonous range plants in Wyoming are confined to small areas it may prove economically sound to use chemicals. Such localized conditions as depressions or swales where snow accumulates and moisture conditions are good during much of the year, or outcroppings of shales which possess certain elements such as selenium, often contain areas of poisonous plants.

In an effort to determine use of 2,4-D and related compounds in control, the University of Wyoming in 1945 established experimental plots on several of the more troublesome farmland weeds and expanded the project to include troublesome poisonous range weeds in 1947. Larkspur, death camas, lupine, locoweed, water hemlock, and various selenium-bearing species, believed to be the most troublesome to Wyoming ranchers, were selected to determine whether or not growth-regulating weed killers could be used as a means of control of poisonous range plants.

Through repeated experiments over the past four years it is possible to recommend use of growth-regulating compounds for control of many of Wyoming's most troublesome poisonous plants. Since 2,4-D and related materials may readily be applied with knapsack sprayer, ground spray-rig, or airplane, they have proved economically sound under many conditions.

In using 2,4-D and 2,4,5-T, the percentage reduction which may be expected from any one application depends upon many factors. Moisture, stage of plant growth when applications are made, and concentration and type of 2,4-D applied, are of prime importance in obtaining
optimum control. As growing conditions become less favorable, the concentration of 2,4-D will need to be increased. In the arid regions where moisture is often the limiting factor for plant growth, it is entirely possible that such poisonous plants as plains larkspur and death camas may become dormant prematurely and in some cases not even produce blossoms and seed in a given season. Under such adverse conditions the control obtained by growth-regulating compounds has been negligible regardless of concentration applied. It is therefore suggested that recommendations made herein be used judiciously. It should further be remembered that while 2,4-D will effectively control many troublesome weeds, it will likewise kill many desirable plants which make up the rangeland vegetation. Therefore, before applying chemicals to a large area it is wise to appreciate fully the possibility that some desirable plants may be killed.

**METHODS OF STUDY**

Experimental plots were located throughout Wyoming on naturally occurring infestations of the various poisonous range plants. Individual treatments varied in size from one square rod to one-fourth acre, depending upon the uniformity and area of infestation. The small plots were treated with a knapsack sprayer while the larger plots were sprayed with a ground spray-rig. All plots were randomized, replicated, and treated over a several-year period to determine the most effective material, concentration, and stage of plant growth for optimum weed control. Permanent quadrats were located within each treated area and plant counts were made to determine the percentage control attained. Since most of the poisonous plants were perennial in nature the treated areas were observed over a period of several years to ascertain fully the actual control resulting from each treatment.

**DEATH CAMAS**

*(Zygadenus gramineus)*

Of the three most common species of death camas in Wyoming, *Z. gramineus* has the widest distribution. Beath et al. *(3)* state that this species occurs in scattered patches over most of the state except in the southwestern part. The species *Z. paniculatus* infests the southwestern portion.

Death camas is a bulbous perennial which starts growth very early in the spring. The plant possesses a grasslike leaf, dark green and very conspicuous against a background of dormant prairie grass. Little

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*Number in italics refers to Literature Cited, p. 19.*
FIG. 1—Death Camas (Zyadenus gramineus)
A, Flower; B, Seed Pod
wonder that considerable losses are suffered by sheepmen and cattlemen
during late March and April from this plant.

Size of infestation may vary from small, isolated spots where mois-
ture and soil are conducive for plant growth to rather extensive acreages. Many times, areas of death camas around shearing sheds or sheep bed-
grounds are a continual source of loss to ranchers.

Although death camas is of the lily family and as such possesses
a grasslike leaf, it is susceptible to 2,4-D. The effect of several growth-
regulating compounds on this plant is shown in Table 1. The ester
formulation is superior to the amine type of 2,4-D as is indicated by
the fact that after one year’s treatment the 2 lb. 2,4-D amine treatment
killed only 12 percent of the plants as compared to the 2 lb. ester
treatment, which killed 65 percent. The 3 lb. ester treatment appeared
to be the best treatment. Through actual plant counts it was found
that infestation of death camas was reduced from population of one
plant per square foot to no plants after one treatment of 3 lbs. ester
at bud stage of growth. It will be noted that second- and third-year’s
treatments were necessary to obtain 100 percent control using 2 lbs.
of 2,4-D ester. In all concentrations applied, 2,4-D was superior to the
ester form of 2,4,5-T.

After extensive observations, Beath concluded that although death
camas blooms annually in June and produces many seeds, the only
observed source of propagation was through production of bulblets
by the mother plant. Hence it is possible to eliminate the infestation
of death camas through control of the mother plants.

For control it is recommended that 3 lbs. of 2,4-D ester be applied
at the early-bud stage of growth. Inspection of the area should be
made the following year and spot treatments on plants that reappear.

LUPINES

(Lupinus species)

A number of the lupine family are not poisonous and are relished
by sheep for forage; however, other members of the family contain
highly toxic alkaloids which cause numerous livestock losses. Greatest
losses are suffered in fall when hungry animals are trailed through
lupine areas. Since the oily pods are attractive especially to sheep but
are very high in poisonous material, proper precautions and manage-
ment practices should reduce the danger of this weed to a minimum.
However, if infestations exist in easily accessible pastures or in trailways,
it may be sound practice to remove the weed with herbicides.

The most common perennial lupine of the plains region of Wyom-
ing is the silvery lupine (Lupinus argenteus) (Beath) (2). Other poi-
<table>
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<tr>
<th>Material</th>
<th>Rate per Acre</th>
<th>1 Yr.</th>
<th>2 Yr.</th>
<th>3 Yr.</th>
<th>1 Yr.</th>
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<td>22</td>
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<td>40</td>
<td>65</td>
<td>36</td>
<td>58</td>
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<td>85</td>
<td>34</td>
<td>62</td>
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FIG. 2—Silvery Lupine (*Lupinus argenteus*)
A, Flower; B, Seed Pod
sonous lupines occur in Wyoming; however, their reaction to 2,4-D and 2,4,5-T has not been fully determined to date.

It will be noted in Table 1 that 2,4-D and 2,4,5-T are approximately equal in effecting control of silvery lupine. The 2 lb. treatment was superior to the 1 lb. treatment in all trials. Approximately 75 percent of the plants were killed with one spraying at the bloom stage of growth. The treatments also prevented formation of seeds and pods—a very desirable factor in preventing livestock losses during the year treated.

While two years' treatment was necessary to eliminate 90 percent of the infestation using 2 lbs. of 2,4-D ester, in all cases the regrowth on the treated plots appeared abnormal and unhealthy regardless of concentration of treatment involved.

Since 2,4,5-T was not superior to 2,4-D, and since cost of the former is about twice as much as 2,4-D, it is suggested that for chemical control of silvery lupine, 2,4-D of either the ester or amine be applied at rate of 2 lbs. per acre during the bud-to-bloom stage of growth. Several years' treatment will be necessary to remove the lupine infestation completely.

As was emphasized earlier, many lupines are not poisonous. It is therefore urged that anyone confronted with an infestation obtain positive identification before spraying to control this plant.

LARKSPUR
(Delphinium species)

Larkspur is probably the most important poisonous plant confronting the cattle industry in Wyoming today. According to Beath et al. (1939) (5), plains larkspur (Delphinium geyeri) is responsible for more cattle losses in Wyoming than all the other larkspurs of the state combined. Another larkspur which frequents the higher forest areas between 8,000 and 11,000 feet elevation is tall larkspur (Delphinium barbeyi). This plant is often a problem to cattlemen who utilize the mountain areas for grazing.

Like many of the other perennial poisonous plants, plains larkspur begins growth very early in spring and forms large green clumps of vegetation before the common grasses of the plains are large enough to be of forage value. Often severe losses due to larkspur are suffered by cattlemen as a result of late spring snow which forms a glazed surface over the prairie vegetation and exposes only large green clumps of larkspur.

For effective control, the larkspur plant must be completely eradicated since the foliage remains poisonous throughout the growing season. Deferred grazing has not helped much to prevent loss. Before se-
FIG. 3—Plains Larkspur (*Delphinium geyeri*)
A, Flower; B, Seed Pod
lective herbicides came into use, much attention was given to eradication through grubbing. Beath et al. (1939) (5) found that it cost $20 to eradicate the larkspur on an acre containing approximately 17,500 plants. In a similar study conducted by A. E. Aldous (1) of the U.S.D.A. in 1917, the first grubbing cost from $3.65 to $10 per acre plus an additional cost of $1 for the second and final grubbing. It was estimated that between 80 and 95 percent of the larkspur was killed. Yet with labor cost at an all-time high it is not difficult to foresee limitations to this type of control at present.

Tall larkspur (D. barbeyi) and plains larkspur (D. geyeri) are quite difficult to eradicate with growth-regulating materials (Bahmont, 1950) (6). Table 1 shows response of plains larkspur to several compounds. It will be noted that after two years the most effective treatment still had 25 percent of the plants remaining. A factor which has probably limited the effectiveness of the first-year treatments as shown in Table 1 was the poor moisture conditions which prevailed throughout the 1948 growing season. In subsequent experiments it was found that by addition of a spreading agent to the 2,4-D salt formulation, the percentage of control was equal to or better than the 2,4-D ester treatments; however, additional experimentation is necessary on this phase.

Although the 2-year treatment of 2 lbs. of 2,4-D ester at bud stage reduced plant population by 75 percent, it is believed that through heavier concentration, or through use of spreader agents, better control can be attained.

The results on tall larkspur indicate that it is slightly easier to kill than the plains larkspur. However, approximately 10 percent of the plants still remained on the area treated with 2 lbs. of 2,4-D ester after two years of treatment. It was noted that the remaining plants were very unthrifty and did not bloom after two years' treatment.

At recommended rate of 2 lbs. of 2,4-D ester, a materials cost at present prices of $2 per acre could be expected. An additional charge for application would necessarily depend on type of equipment used.

LOCOWEED

(Oxytropis species)

Probably one of the most common groups of poisonous plants in the West is locoweed, which consists of two genera (Astragalus and Oxytropis). Many of the common species are not poisonous; however, the common white locoweed (O. saximontana) and the purple locoweed (O. lambertii) are poisonous to all kinds of livestock and are abundant in Wyoming. White locoweed is common throughout Wyoming while the purple locoweed is confined to the eastern part of the state. A large,
abandoned area in Southeastern Wyoming became so infested with white locoweed that the rancher was forced to discontinue use as a horse-pasture. In effort to reclaim the land, locoweed was sprayed with unrefined petroleum oil at rates of 100 to 200 gallons per acre. Treatments, made in 1945, were ineffective. Subsequent studies on the area indicate that virtually 100 percent control can be attained by applying 2,4-D at 2 lbs. per acre during the bloom stage of growth (Bohmont, 1950) (7).

Studies conducted on both the purple and the white locoweed indicate that the plant is easily controlled with 2,4-D of either the ester

FIG. 4—Common White Locoweed (*Oxytropis saximontana*)
A, Flower; B, Seed Pod
FIG. 5—Two-grooved Milk Vetch (Astragalus bisulcatus)
A, Flower; B, Seed Pod

or the amine formulation. Under good growing conditions 1 lb. of 2,4-D per acre produces good control. However, as the moisture becomes limiting, the higher rate of 2 lbs. per acre is recommended. No difference was observed in applying the chemical in either water or oil.

SELENIUM-BEARING PLANTS

Although presence of an unexplained disease in livestock termed "alkali disease" had been known to exist before 1900, the fact that
selenium was the cause of this obscure poisoning was not found until 1934 (Beath et al., 1934) (4). Seleniferous vegetation differs from ordinary poisonous plants in that certain plants absorb selenium from the soil and accumulate it in the vegetative portion, whereas ordinary poisonous plants produce toxic substances through normal metabolic processes. In addition to several of the common milk-vetch species (Astragalus sp.), which are indicators of seleniferous areas, several other plants commonly inhabit these areas and when present definitely show that selenium is in the soil. Of these, woody aster (Xylorrhiza sp.) is probably the most common.

Since soil selenium is converted by indicator plants to an available form and thus is made available to and is absorbed by other plants such as grasses and grains, it is highly important that the indicator plants be controlled or removed from infested areas. All indicator plants treated with 2,4-D and 2,4,5-T to date may be classified as susceptible to growth-regulating compounds.
As indicated in Table 1, the two-grooved milk vetch (*A. bisulcatus*) is readily controlled with either 2,4-D or 2,4,5-T at rates of 1 to 2 lbs. per acre. The 2 lb. treatment of all chemicals produced 100 percent control. Treatments should be made at the bud stage of growth.

Narrow-leafed milk vetch (*A. pectinatus*) is more difficult to control than two-grooved milk vetch, as is indicated in Table 1. Two years' treatment at 3 lbs. of 2,4-D ester were necessary to obtain 100 percent control. The ester of 2,4-D appeared to be the best material. Rates less than 2 lbs. per acre were ineffective.

Woody aster (*X. parryi*) is very susceptible to 2,4-D or 2,4,5-T and can be readily controlled with 1 or 2 lbs. per acre. One year's treatment appears to be sufficient. Treatments should be made early in spring when plants are in full bloom.

FIG. 7—Halogeton (*Halogeton glomeratus*)
A, Winged Fruit; B, Seed with Winged Appendage Removed; C, Fleshy Stem and Leaves
Princes plume (*Stanleya* species), an indicator plant, is readily controlled with growth-regulating compounds. Concentrations of 1 to 2 lbs. of 2,4-D or 2,4,5-T per acre completely eliminated this plant. Since infestations usually consist of sparsely located plants it is possible to control an infested area effectively through spot treatment of each individual plant.

**HALOGETON**  
(*Haloegeton glomeratus*)

This is a relatively new poisonous plant to Northern Wyoming. It was first recorded in Nevada in 1935; infestations have since been found throughout the western range areas. While only an annual weed reproducing by seed, it has caused considerable worry among livestock growers. The plant is very fleshy, containing 80 percent or more of water. The poisonous properties are attributed to its oxalate content, which may vary under natural conditions from 10 to 20 percent.

Although no death losses attributable directly to halogeton have been reported in Wyoming to date, there is a rather large area of infestation in the northern part of the state. The plant thrives in poor soil which is very alkaline (8.2-8.6 pH); however, it will also live in more fertile soil. The weed, very drought-resistant, invades bare ground wherever such condition exists near contaminated areas.

While it is important that one become familiar with the dangers of this weed and the problems it presents, there is no occasion for hysteria. The weed has been overpublicized and should not be overrated as a poisonous plant. The largest area of infestation in Wyoming encompasses approximately 767,232 acres in the Greybull, Powell, Frankie, and Kane areas, in which it is confined to waste areas, abandoned farm lands, rights of way, sparsely vegetated rangeland, and along canals, in corners of unkept fields, along pipelines and other disturbed areas (Bohmont, 1951) (9).

It should be fully understood that halogeton is very unpalatable and would probably not be eaten by an animal unless starved to it. The Nevada Agricultural Experiment Station (12) was unsuccessful in forcing sheep held off feed to eat fresh or dried halogeton. It is apparent that, through proper management, losses due to halogeton can be prevented.

Applications of 2,4-D at 2 lbs. per acre in both the ester or amine formulation have proved effective in killing halogeton. Pentachlorophenol (PCP) at 2 lbs. per acre in diesel fuel completely killed all plants growing on the area during treatment. However, germination of dormant seed after receipt of additional moisture completely overshadowed any control obtained earlier. Since halogeton is an annual
FIG. 8—Water Hemlock (*Cicuta occidentalis*) with cross section of stem

A, Flower; B, Capsule
and as such spreads entirely by seed, use of chemicals seems to be only a partial solution because seed continues to germinate. It has also been noted that, in treated areas where 98 percent of the stand was killed, the remaining plants efficiently utilized the additional available space and moisture made bare by the treatment, and grew 10 to 20 times the size of the untreated plants. Seeding of crested wheat has been reported as effectively holding this weed in check. Additional observations indicate that rolling or crushing of the weeds with press wheels may be an effective treatment.

Additional research must be done to determine the most effective means of containing and eliminating this weed. Vigilance of all ranchers should be maintained to observe and report all infestation; however, fears of invasion of productive farmland or of properly managed rangeland should be dispelled.

**OTHER POISONOUS PLANTS**

Many other common weeds are poisonous and as such should be considered as possible source of loss in a ranch enterprise; however, the areas of infestation are often very small and isolated.

Each year Wyoming ranchers suffer some loss of livestock due to water hemlock (*Cicuta* sp.). This weed can effectively be controlled with 2 lbs. of the ester of 2,4-D applied to the pre-bud stage of growth. Later treatments have not appeared as effective (Bohmont, 1950) (8).

Cocklebur (*Xanthium* sp.) is a source of poisoning around many farmsteads. In the cotyledon stage of growth this annual can be readily controlled with \(\frac{1}{2}\) lb. of 2,4-D per acre; however, as cocklebur plants mature, a heavier concentration is necessary. It should be remembered that since each bur contains two embryos, there is possibility of several years of infestation resulting from one seed set. Several years of treatment may be necessary to clean up an infested area completely.

Greasewood (*Sarcobatus vermiculatus*) is a perennial spiny shrub which is common on alkali areas of Wyoming. While it is often considered a good sheep forage, it can cause poisoning if eaten in considerable quantity (Marsh, 1923) (10). The poisonous property is the same as that found in halogoton and may be as high as 15 percent.

While good management practices will prevent losses due to greasewood, it may readily be controlled with 2,4-D. Concentration from 1 to 2 lbs. per acre of either type of 2,4-D has resulted in 100 percent kills.

**THE OUTLOOK**

While control of poisonous range plants can be effected through proper application of growth-regulating compounds, it should be under-
stood that there are many methods of prevention and control. Livestock loss due to poisonous plants is not a new problem confronting the modern-day rancher; the rancher of 50 years ago was faced with the same problem of poisonous plants.

It is interesting to note that in one of the first publications on weeds, entitled “Worst Weeds of Wyoming”, published in 1896 (11), the author, Aven Nelson, observed that “Weeds, like the poor, we have always with us, and again like the poor, they are the most numerous in the most shiftless communities.” The statement is as true today as then. There is no substitute for good management practices. Selective herbicides can well be considered among the many modern tools available for control of poisonous weeds by the good manager.

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